AZ DISPLAYS, INC.

COMPLETE LCD SOLUTIONS

SPECIFICATIONS FOR LIQUID CRYSTAL DISPLAY

PART NUMBER:	ACM1602U Series
DATE:	August 16, 2004

1. FEATURES

* Display mode : STN
* Background: : Gray or Yellow
* Polarizer: : Reflective, Transflective, or Transmissive
* Display Format : 16 X 2 Characters
* IC : NOVATEK NT7605H-BDT01
* Driving Method : 1/16 Duty, 1/5 Bias
* Viewing Direction : Top or Bottom
* Backlight : None

2. MECHANICAL SPECIFICATIONS

Item	Specification	Unit
Module Size	65.0(W) X 27.7(H) X 1.85max(T)	mm
Viewing Area	61.0MIN (W) X 15.7MIN(H)	mm
Character Font	5 X 7 Dots	
Character Size	2.95(W) X 5.15(H)	mm
Dot Pitch	0.60(W) X0.65(H)	mm
Dot Size	0.55(W) X 0.60(H)	mm

3. ELECTRICAL SPECIFICATIONS

3-1. Absolute Maximum Ratings (Vss=0V)

Item	Symbol	Standard Value			Unit
		Min.	Typ.	Max.	
Supply Voltage For Logic	V_{DD}-V_{SS}	-0.3	-	7.0	V
Supply Voltage For LCD Drive	V_{DD} -V_L	0	-	V_{DD}+0.3	V
Input Voltage	V_I	0.33	-	V_{DD}+0.3	V
Operating Temp.	T_{OP}	-20	-	+70	°C
Storage Temp.	T_{ST}	-30	-	+80	°C

3. ELECTRICAL SPECIFICATIONS (Continued)

3-2. Electrical Characteristics (Vss=0V)

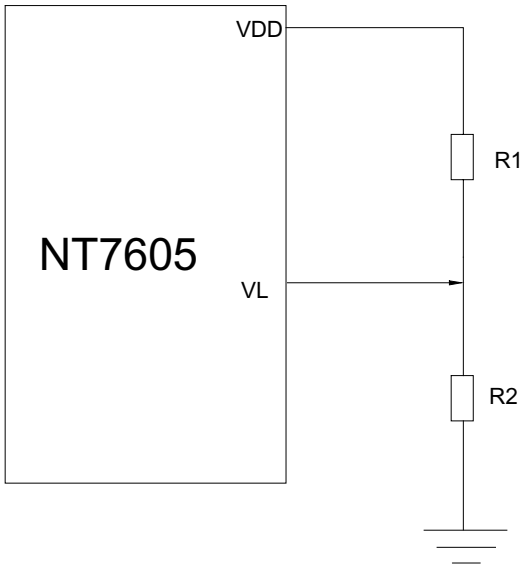
Item		Symbol	Test Condition	Min.	Typ.	Max.	Unit
Logic Supply Voltage		$V_{DD} - V_{SS}$	Ta=0~50°C	4.5	5.0	5.5	V
LCD Drive Voltage (Recommended Voltage)		$V_{DD} - V_L$	Ta=25°C	4.0	4.4	4.9	V
Input Voltage	"H" Level	V_{IH}	V_{DD}=5V**+/-** 5%	0.8 V_{DD}	-	V_{DD}	V
	"L" Level	V_{IL}		-0.3	-	0.2 V_{DD}	V
Output Voltage	"H" Level	V_{OH}	V_{DD}=5V**+/-** 5%	V_{DD}-0.6	-	-	V
	"L" Level	V_{OL}		-	-	$_{GND}$+0.6	V
Current Consumption		I_{DD}	V_{DD} =5V**+/-** 5% V_{DD}-V_0=4.5V	-	1.25	2.0	mA
Frame Frequency		-	V_{DD}=5V	-	84.3	-	HZ

NOTE: 1) Duty Ratio=1/16, Bias Ratio=1/5

2) Measuring in Dots ON-state

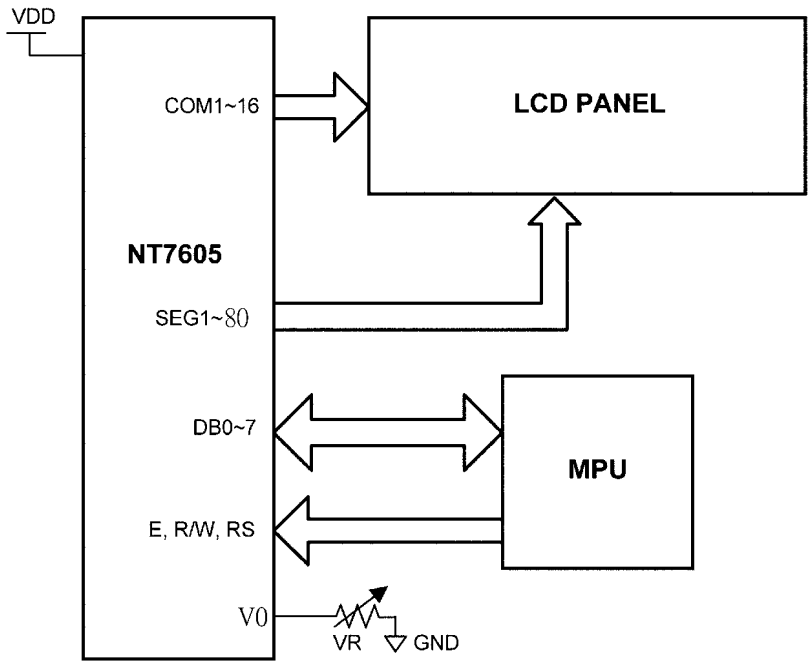
4. BLOCK DIAGRAM AND POWER SUPPLY

4-1. POWER SUPPLY



Note : Vop =V_{DD}-VL ; R1+R2 = 10K-Ohm ~ 20K-Ohm

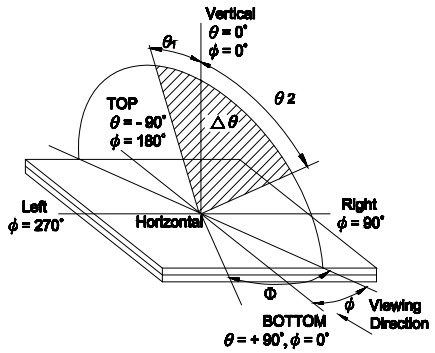
4-2. BLOCK DIAGRAM



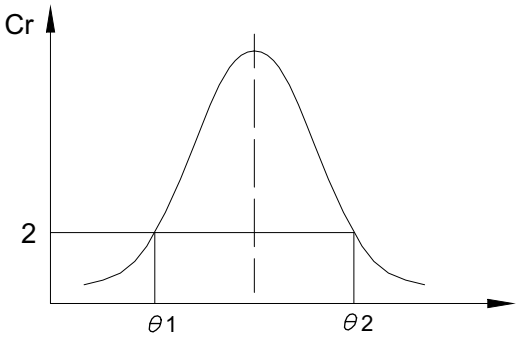
5. ELECTRO – OPTICAL CHARACTERISTICS

Item	Symbol	Temp.	Min.	Typ.	Max.	Unit	Conditions	Note
Viewing Angle	$\theta 2 - \theta 1$	25C	30	100	-	Deg.	-	1,2
	ϕ		80	93	-			
Contrast Ratio	Cr	25C	2	3.38	5.67	-	θ =0° ϕ =0°	3
Response Time(rise)	Tr	25C	-	64	250	ms	θ =0° ϕ =0°	4
		0C	-	950	1150			
Response Time(fall)	Tf	25C	-	120	250	ms	θ =0° ϕ =0°	4
		0C	-	950	1150			

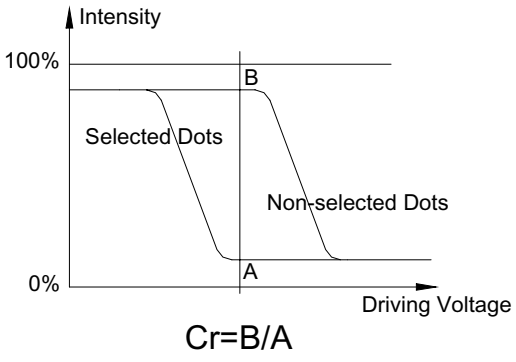
Note1 . Definition of Angle θ & ϕ



Note2. Definition of Viewing Angle $\theta 1$& $\theta 2$

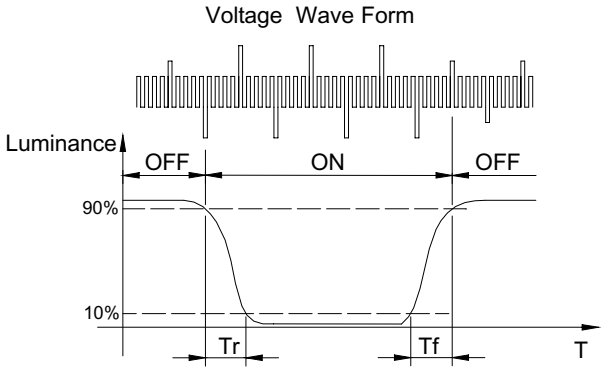


Note3 . Definition of Contrast Cr



Cr=B/A

Note4. Definition of Optical Response



6. TERMINAL PIN FUNCTION

6-1. Interface Pin Function Description

Pin NO.	Symbol	I / O	Functions
1	VSS	P	Power supply (VSS=0V)
2	VL	P	LCD Operating Voltage
3	VDD	P	+5V
4	RS	I	Register select signal
5	R/W	I	Read/Write control signal
6	E	I	Enable signal (Schmitt trigger input)
7	DB0	I/O	Lower 4 tri-state bi-directional data bus for transmitting data between MPU and NT7605. Not used during 4-bit operation.
8	DB1		
9	DB2		
10	DB3		
11	DB4	I/O	Higher 4 tri-state bi-directional data bus for transmitting data between MPU and NT7605. DB7 is also used as busy flag.
12	DB5		
13	DB6		
14	DB7		

7.TIMING CHARACTERISTICS

Symbol	Parameter	Min.	Typ.	Max.	Unit	Conditions
t_{CYCE}	Enable Cycle Time	500	-	-	ns	Figure 2
t_{WHE}	Enable "H" Level Pulse Width	300	-	-	ns	Figure 2
t_{RE}, t_{FE}	Enable Rise/Fall Time	-	-	25	ns	Figure 2
t_{AS}	RS, R/W Setup Time	60[1]	-	-	ns	Figure 2
		100[2]				
t_{AH}	RS, R/W Address Hold Time	10	-	-	ns	Figure 2
t_{DS}	Data Output Delay	100	-	-	ns	Figure 2
t_{DHW}	Data Hold Time	10	-	-	ns	Figure 2

Notes: 1: 8-bit operation mode
2: 4-bit operation mode

Read Operation

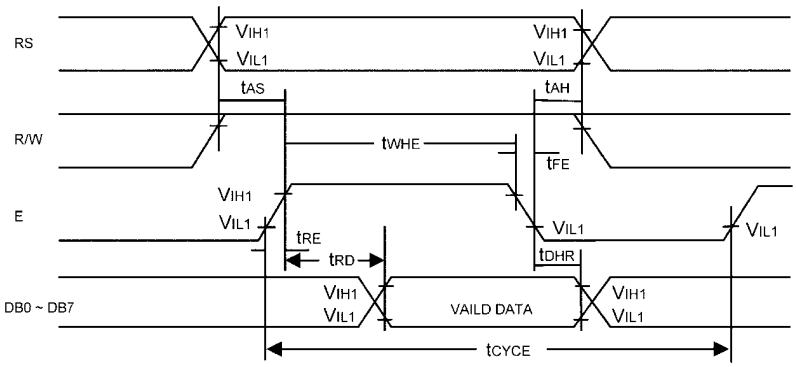


Figure 1. Bus Read Operation Sequence
(Reading out data from NT7605 to MPU)

Write Operation

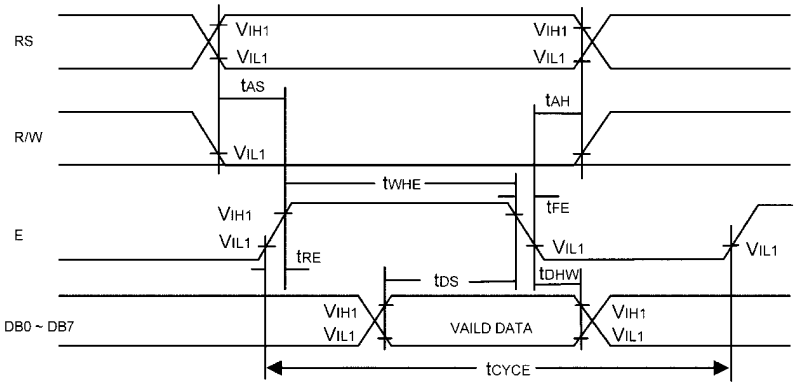


Figure 2. Bus Write Operation Sequence
(Writing data from MPU to NT7605)

8.INSTRUCTION SET

8-1. Instruction Table

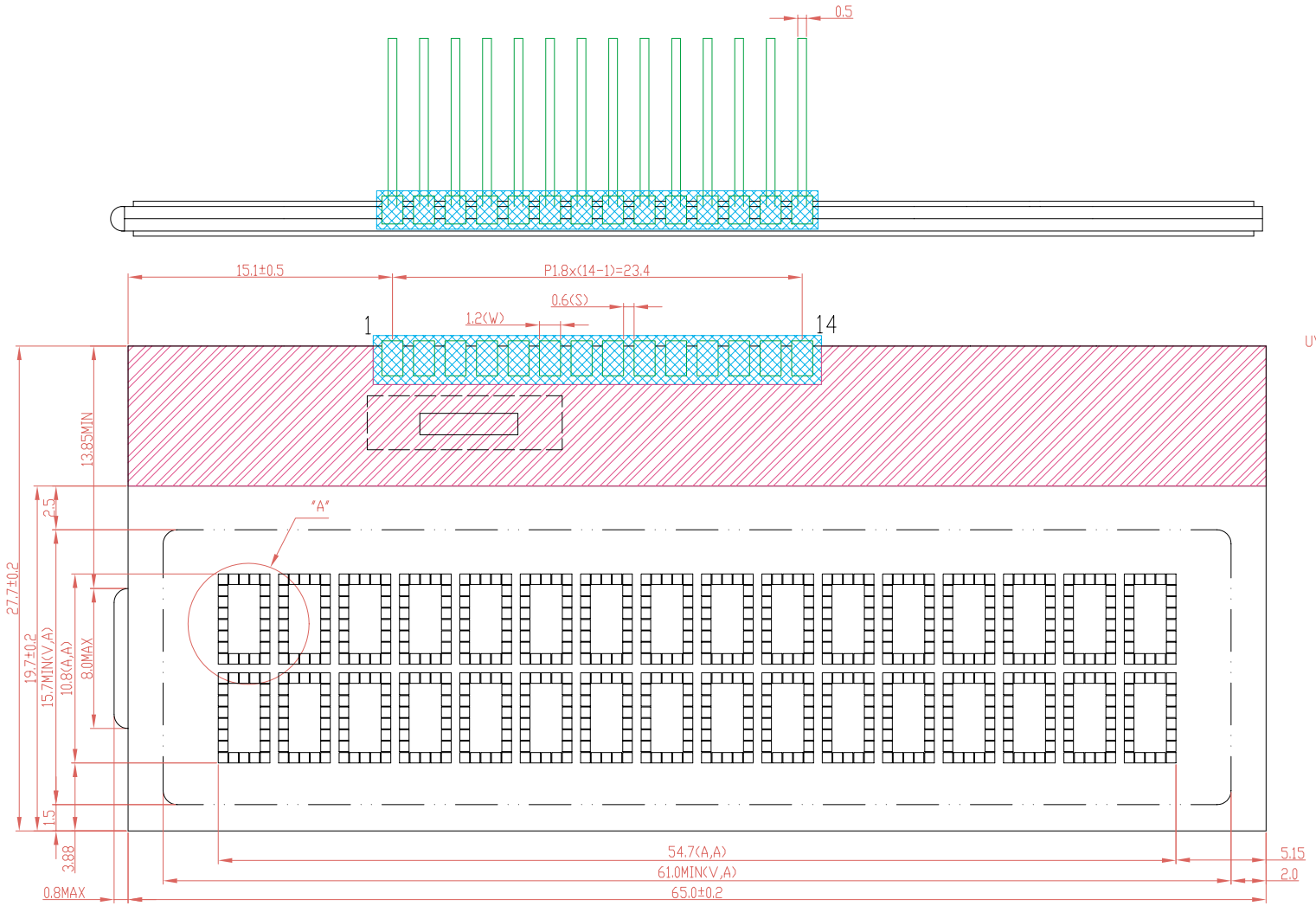
Instruction	Code										Function	Execution time (max) (f_{osc} = 250KHz)
	RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		
Display Clear	0	0	0	0	0	0	0	0	0	1	Clear entire display area, Restore display from shift, and load address counter with DD RAM address 00H.	1.64ms
Display/ Cursor Home	0	0	0	0	0	0	0	0	1	*	Restore display from shift and load address counter with DD RAM address 00H.	1.64ms
Entry Mode Set	0	0	0	0	0	0	0	1	I/D	S	Specify direction of cursor movement and display shift mode. This operation takes place after each data transfer (read/write).	40µs
Display ON/OFF	0	0	0	0	0	0	1	D	C	B	Specify activation of display (D) cursor (C) and blinking of character at cursor position (B).	40µs
Display/ Cursor Shift	0	0	0	0	0	1	S/C	R/L	*	*	Shift display or move cursor.	40µs
Function Set	0	0	0	0	1	DL	N	F	*	*	Set interface data length (DL), number of display line (N), and character font (F).	40µs
RAM Address Set	0	0	0	1	ACG						Load the address counter with a CG RAM address. Subsequent data access is for CG RAM data.	40µs
DD RAM Address Set	0	0	1	ADD							Load the address counter with a DD RAM address. Subsequent data access is for DD RAM data.	40µs
Busy Flag/ Address Counter Read	0	1	BF	AC							Read Busy Flag (BF) and contents of Address Counter (AC).	1µs
CG RAM/ DD RAM Data Write	1	0	Write data								Write data to CG RAM or DD RAM.	40µs
CG RAM/ DD RAM Data Read	1	1	Read data								Read data from CG RAM or DD RAM.	40µs
	I/D = 1 : Increment S = 1 : Display Shift On D = 1 : Display On C = 1 : Cursor Display On B = 1 : Cursor Blink On S/C = 1 : Shift Display R/L = 1 : Shift Right DL = 1 : 8-Bit N = 1 : Dual Line F = 1 : 5x10 dots BF = 1 : Internal Operation BF = 0 : Ready for Instruction						I/D = 0 : Decrement S/C = 0 : Move Cursor R/L = 0 : Shift Left DL = 0 : 4-Bit N = 0 : Signal Line F = 0 : 5x8 dots				DD RAM : Display Data RAM CG RAM : Character Generator RAM ACG : Character Generator RAM Address ADD : Display Data RAM Address AC : Address Counter	

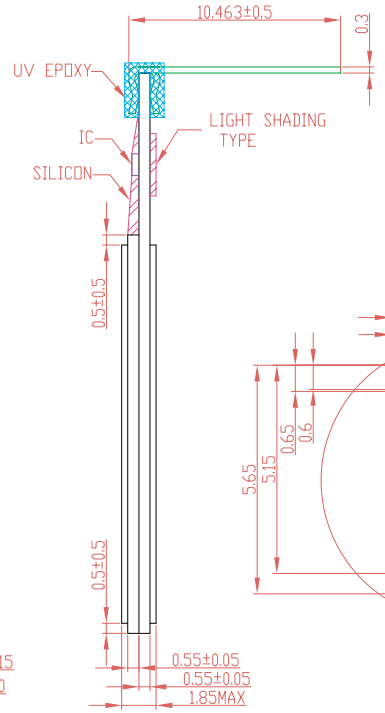
Note 1: Symbol "*" signifies an insignificant bit (disregard).
Note 2: Correct input value for "N" is predetermined for each model.

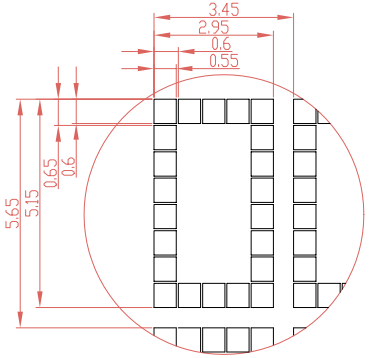
9. FONT TABLE


Higher 4-bit (D4 to D7) of Character Code (Hexadecimal)
0
1
2
3
4
5
6
7
8
9
A
B
C
D
E
F
Lower 4-bit (D0 to D3) of Character Code (Hexadecimal)
CG RAM (1)
CG RAM (2)
CG RAM (3)
CG RAM (4)
CG RAM (5)
CG RAM (6)
CG RAM (7)
CG RAM (8)

REV	REVSION RECORD	DATE	APPROVED	NAME
1				







DETAIL:A
SCALE:2x

NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
SYMBOL	VSS	VL	VDD	RS	RW	E	DB0	DB1	DB2	DB3	DB4	DB5	DB6	DB7

	TOLERANCE	MATERIAL	FINISH	AZ DISPLAYS, INC.
	±0.2			
VERSION	SCALE	NO.	UNIT	TITLE ACM1602U Series
A		1/1	mm	
DATE	APPROVED	CHECKED	DRAWN	FILE NAME
2004.04.07			劉峰	205:\D\LF\GX1602D5